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(54) METHOD FOR PUMPING IN WELL

(57) Abstract:

FIELD: pumping in horizontal wells. SUBSTANCE: critical zone is isolated above productive strata. The isolating is carried out prior to opening the productive strata. Filter-tail and development string are lowered into the well. filter-tail cavity is closed by lintel. filter-tail and development string are lowered individually. Filter-tail is lowered first. Profile pipes are lower together with the filter-tail. Upper part of the filter-tail is secured by the pipes. Development string first is lowered to the cavity of profile pipes. The pipes are lowered so to form a gap between lower end of the development string, walls of profile pipes and lintel. Then the development string achieves upper end of the filter- tail. This operation is carried out after pumping in mortar. Then they wait until the mortar gets hard. Then the lintel is broken. EFFECT: higher reliability. 2 cl, 4 dwg

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## Description [Описание изобретения]:

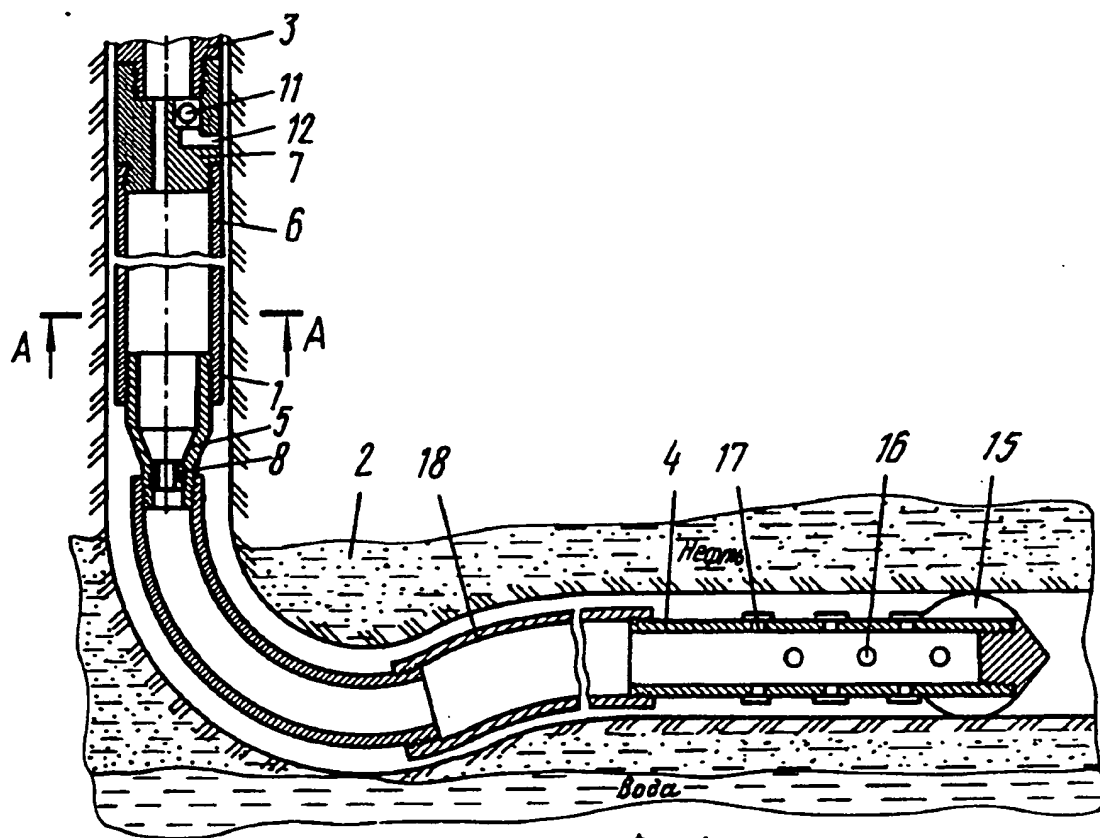
Изобретение относится к технологии заканчивания строительства скважины, преимущественно имеющей горизонтальный участок ствола в продук

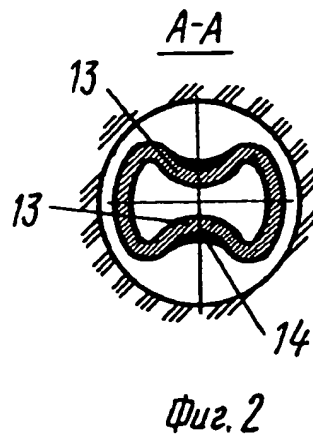
На фиг. 1 показан комплект оборудования для спуска и установки фильтра-хвостовика в скважину; на фиг. 2 сечение А-А на фиг. 1; на фиг. 3 - принципиальная схема установки фильтра-хвостовика в скважине и исход

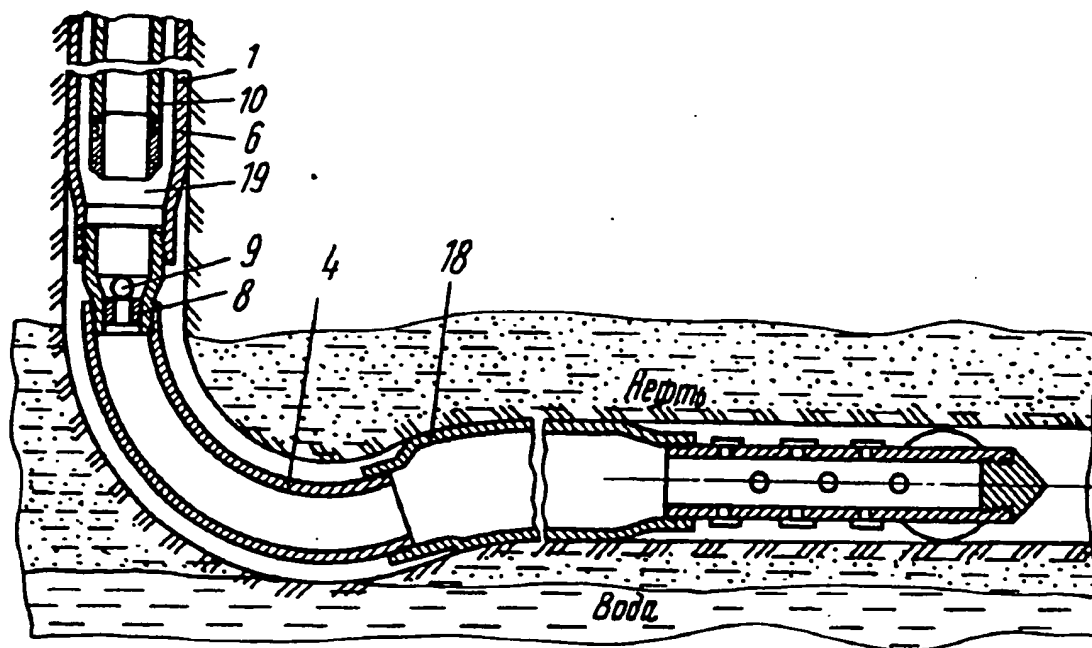
Claims [Формула изобретения]:

1. Способ заканчивания скважины, включа

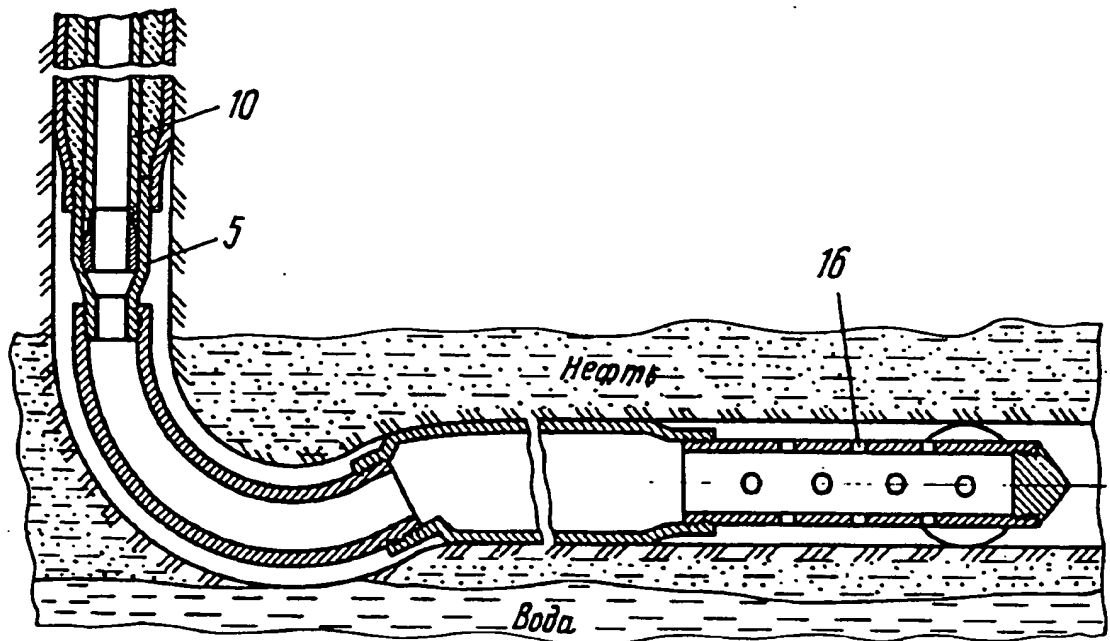
Drawing(s) [Чертеж]:











Фиг. 4

**(54) WELL COMPLETION METHOD**

**(57) Abstract:**

**Use:** For completion of horizontal wells. The method improves the reliability of isolating a producing formation with cement slurry when cementing a production well. **Substance of invention:** The troublesome zone located above the producing formation is isolated therefrom. Isolation is performed before exposing the producing formation. A liner filter is lowered into the production well. The filter inside is sealed off with a stopping device. The liner filter and the production casing string are lowered into the well separately. First, the liner filter is lowered. At the same time, shaped pipes are lowered into the well. They are used to secure the top part of the liner filter after its lowering. Initially, the production casing string is lowered into the shaped pipes. When lowering these pipes, a clearance is formed by the bottom part of the production casing string, the walls of the shaped pipes and the stopping device. Thereupon, the flow string is lowered to the top end of the liner filter. This operation is performed after pumping in cement slurry. Then, the cement slurry is allowed to solidify. Following this, the stopping device is broken. When non-producing regions are exposed in the horizontal section of the well they are isolated from the producing ones by means of shaped pipes. These pipes are lowered into the well at the same time as the liner filter. 1 cl., 4 ill. [illegible]

**Description:**

The present invention relates to a method for completing the construction of a well having a mostly horizontal section whose section passing through a producing formation.

A method for completing a well whose borehole has a horizontal section is known, which method consists in lowering a pre-perforated liner attached to a production casing string, isolating the casing string-borehole annulus in the production formation zone from the above and alternating non-producing formations by use of outside packers, and cementing the production casing string above the liner with the use of a cementing collar (1).

However, the isolation of the casing string-borehole annulus in the production formation zone from the above and alternating non-producing formations by use of outside packers, and the cementing of the production casing string above the liner are not reliable—especially in the transition zones between the vertical and horizontal sections of the borehole—because drilling mud is not completely replaced with cement slurry. Besides, due to the fact that packers are small in size their sealing surfaces are not able to reliably seal off the cavernous zones when these zones are larger than the area of the sealing surfaces of the packer.

This problem is exacerbated in the event that poorly cemented rock is exposed in the course of drilling a well since in such cases rock fall may occur, especially after washing the well and removing the colmatation cake from its walls.

The well completion method which is closest to the proposed one in its substance and in the number of coinciding distinctive features consists in isolating the troublesome zones above the producing formation prior to its exposure, lowering a liner filter and a production casing string into the well, temporarily filling the filter zone of the well with sealing agent, sealing off the inside of the liner filter with a stopping device, pumping in cement slurry, allowing the cement slurry to solidify and breaking the stopping device (2).

This method does not ensure a reliable isolation of the producing formation from the nonproducing ones, either, because of an incomplete removal of the drilling mud from the inclined and horizontal sections of the borehole, in which the solid phase of the drilling mud precipitates while drilling mud is circulated. This problem is exacerbated by an incomplete removal of mud cake, and, besides, the probability of rock fall increases in the zones where mud cake is removed, which affects the formation isolation quality, too.

Besides, it is impossible to properly cement the production casing string in the above borehole sections, especially when drilling poorly cemented rock, because the centralizers press into this rock, which results in a nonuniform thickness of the cement ring wall.

Another drawback to the known method is the blocking of part of the producing formation with cement slurry supplied to the filter zone of the well when cementing the production casing string, which blocking results from the fall and the accumulation of the temporary sealing agent in the bottom part of the horizontal section which is quite long and also from the formation of voids in the top part of the borehole, which are filled with cement slurry in the course of cementing the production casing string.

The object of the present invention is to improve the reliability of isolation of a producing formation from nonproducing ones and to preclude the blocking of a producing formation by cement slurry when cementing the production casing string.

This object is achieved as follows: When using the proposed well completion method consisting in isolating the troublesome zones above the producing formation prior to its exposure, lowering a liner filter and a production casing string into the well, sealing off the inside of the liner filter with a stopping device, pumping in cement slurry, allowing the cement slurry to solidify and breaking the stopping device in the event of completing a well whose horizontal section passes through a producing formation the liner filter and the production casing string are lowered into the well separately with the liner filter being lowered first but at the same time as shaped pipes which are used to secure the top part of the liner filter after its lowering and the production casing string is initially lowered into the shaped pipes so that a clearance is formed by the bottom part of the production casing string, the walls of the shaped pipes and the stopping device, whereupon the production casing string is lowered to the top end of the liner filter after pumping in cement slurry.

When non-producing regions are exposed in the horizontal section of the well they are isolated from the producing ones by means of shaped pipes which are lowered into the well at the same time as the liner filter.

Fig. 1 shows equipment for lowering a liner filter into the well and installing it therein, Fig. 2 is the section A-A in Fig. 1, Fig. 3 shows schematically how the liner filter is installed in the well and the initial layout of equipment for cementing a production casing string, and Fig. 4 is a schematic diagram illustrating the proposed method for completing a well after performing all the operations.

The proposed method is as follows. Prior to exposing the producing formation 2 (Fig. 1) in the course of drilling the well 1, all those nonproducing formations above the producing one, that do not meet the drilling conditions, are isolated, and after the producing formation is exposed and the borehole is washed a pre-perforated liner filter 4 connected to drill string 3 by means of adapter 5, shaped pipes 6 and adapter 7 is lowered into the well on the drill string 3. The adapter 5 is fitted with a stopping device which consists of seat 8 and ball valve 9 (Fig. 3) and which serves to isolate the inside of the liner filter 4 from that of production casing string 10 (Fig. 3), and the adapter 7 is fitted with valve 11 serving to shut off channel 12 communicating the inside of the drill string 3 with the well 1 and serving to fill the drill string 3 with well fluid when lowering the equipment into the well. The shaped pipes 6 have longitudinal corrugations 13 (Fig. 1)

filled with sealing compound 14. The liner filter 4 is centered in relation to the walls of the well 1 by the use of centralizers 15.

Before drilling nonproducing zones in the horizontal section of the borehole or close to it (see Figs. 1, 3 and 4), perforations 16 in the liner filter 4 are closed with plugs 17 made of a chemically destructible material, for instance, magnesium and additional shaped pipes 18 are installed in the corresponding section of the liner filter 4 to isolate the producing part of the formation from the nonproducing one.

Once the liner filter 4 reaches the well bottom, the pressure needed to straighten the longitudinal corrugations 13 and force the walls of the pipes 6 against those of the well 1 (Fig. 3) is developed within the shaped pipes by pumping in washing fluid.

When additional shaped pipes 18 are installed on the liner filter 4 to isolate the producing part of a formation from its nonproducing part, for instance, a water-bearing stringer (Fig. 3), the hydraulic pressure which is developed in the system also straightens these pipes and forces their walls tightly against the well walls thereby isolating the above parts of the exposed horizon from each other in combination with sealing compound 14.

Then, the drill string 3 (Fig. 1) with the adapter 7 is disconnected from the shaped pipes 6 and lifted out of the well 1 and an expander (not shown in the drawings) is connected to the drill string instead, whereupon the drill string is lowered into the well until it enters the top part of the shaped pipes 6. By rotating the drill string 3 together with the expander the corrugations 13 are finally straightened and the walls of the shaped pipes are tightly pressed against the walls of the well 1 (Fig. 3). The sealing compound 14 (Fig. 2) ensures a reliable isolation of the casing string-borehole annulus.

Following this, the drill string 3 with the expander is lifted out of the well and the production casing string 10 (Fig. 3) is lowered into the well and the bottom end of the casing string 10 enters the shaped pipes 6 with the result that a clearance is formed by this end, the seat 8 and the walls of the shaped pipes 6. Then, the ball valve 9 is dropped into the well 1; the valve falls onto the seat 8 isolating the inside of the liner filter 4 from that of the production casing string 10. Cement slurry is pumped into the production casing string 10, whereupon the casing string is lowered until its bottom end abuts against a neck provided in the adapter 5 (Fig. 4); after the solidification of the cement slurry the cement plug formed inside the production casing string 10, as well as the ball valve 9 and the seat 8 are broken by drilling them out.

When temporary plugs 17 have been installed in the liner filter 4, they are broken by pumping in a definite quantity of acid (Fig. 4). Thereupon, the well completion operations are carried out.

The proposed method makes it possible to reliably isolate a producing formation from the above nonproducing formations and also from other adjacent alternating regions in the horizontal section of the well without cementing the liner filter. (drawings)

**Claims:**

1. A well completion method consisting in isolating the troublesome zones above the producing formation prior to its exposure, lowering a liner filter and a production casing string into the well, sealing off the inside of the liner filter with a stopping device, pumping in cement slurry, allowing the cement slurry to solidify and breaking the stopping device wherein in the event of completing a well whose horizontal section passes through a producing formation the liner filter and the production casing string are lowered into the well separately with the liner filter being lowered first but at the same time as shaped pipes which are used to secure the top part of the liner filter after its lowering and the production casing string is initially lowered into the shaped pipes so that a clearance is formed by the bottom part of the production casing string, the walls of the shaped pipes and the stopping device, whereupon the production casing string is lowered to the top end of the liner filter after pumping in cement slurry.
2. The method according to i. 1, wherein in the event of exposing nonproducing regions in the horizontal section of the well these regions are isolated from the producing ones with additional shaped pipes which are also lowered into the well at the same time as the liner filter.

**Drawings:**

*Fig. 1*

*Fig. 2*



*Fig. 3*



TRANSPERFECT | TRANSLATIONS

## AFFIDAVIT OF ACCURACY

I, Kim Stewart, hereby certify that the following is, to the best of my knowledge and belief, true and accurate translations performed by professional translators of the following patents from Russian to English:

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WO 95/03476

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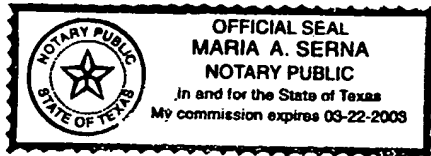


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